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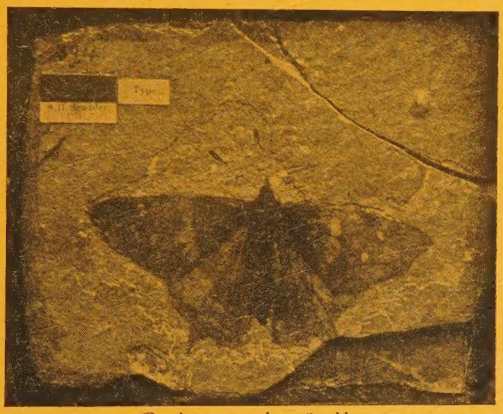

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VESPA ARCTICA ROHWER, A PARASITE OF *VESPA DIABOLICA* DE SAUSSURE.[1]

By W. M. Wheeler and L. H. Taylor.

The summer of 1921, at least in New England, was a "wasp summer," probably on account of the protracted, hot, dry weather during June and July. Certain species of *Vespa,* especially the common yellow-jacket, *V. diabolica,* were unusually abundant. Probably for this reason we were able to make the following observations on a rare wasp, *V. arctica,* which, as shown by Fletcher in a paper read before the Entomological Society of America (1908), is a parasite in the nest of *diabolica.* Unfortunately, Fletcher died before he could publish his paper, and the very brief notice of it in the proceedings of the Society is all that has appeared.

During the summer of 1921 the senior author spent his vacation at Colebrook, in the Litchfield Hills of Connecticut; the junior author at Forest Hills, near Boston. In both places a number of *diabolica* nests were examined, and in three of them *arctica* was taken. The latter species[2] is black and white, and in size and markings may be very readily mistaken for *V. consobrina* De Saussure, but closer examination shows that it has long cheeks and long hairs on the tibiæ. It lacks, moreover, the worker caste, and therefore differs from all known species of *Vespa,* except *austriaca* Panzer, which will be considered more fully in the sequel. This absence of the worker caste at once suggests that *arctica* is a social parasite like the species of *Psithyrus* in the nests of bumble-bees and certain ants (*Anergates, Epoecus, Epipheidole, Sympheidole, Anergatides,* etc.) in the nests of *Tetramorium, Monomorium* and

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 195.

[2] This species was originally described by Lewis (Trans. Amer. Ent. Soc. 24, 1897, p. 173) as **Vespa borealis,** but Rohwer (in Viereck, Hymenoptera, or Wasp-like Insects of Connecticut, 1916, changed the name to **arctica,** as Kirby had previously described a **V. borealis** (Fauna Boreali-Americana, 1837, p. 264).

Pheidole. *V. arctica* belongs to the Canadian and Upper Transition zones. Sladen (1918) records it as ranging from Nova Scotia to British Columbia. It has been recorded from Amherst, Mass., according to Rohwer (Viereck, 1916), and by him included in the list of Connecticut Hymenoptera as probably occurring in that state. The senior author has taken it repeatedly but sparingly at Colebrook (1200-1600 ft.) during the summers of 1918 and 1919, on the flowers of *Spiræa salicifolia*. Until it was taken by the junior author at Forest Hills during the past summer, there was no record of its occurrence near sea-level and in Eastern Massachusetts.

The three observations that go to confirm Fletcher's contention that *arctica* is a social parasite in the nests of *diabolica* are the following:

1. On July 4, the senior author's attention was called to a *diabolica* nest attached to the bottom of the back-net of his tennis-court, at the surface of the ground, in a bunch of grass and sensitive fern. As the wasps were intimidating the players, the colony was asphyxiated after dusk on July 7 by throwing cloths saturated with carbon bisulphide over the nest. On removing the cloths on the following morning, the nest and its occupants were carefully examined. The structure had attained the size and shape of an orange about 12 cm. in diameter, and contained two broadly elliptical combs, a larger, upper, measuring 8 by 6.5 cm., and a smaller, lower, measuring 7 by 5 mm. There were 64 wasps in the colony, 62 workers of *diabolica*, a queen of the same species, and a queen *arctica*. The upper and older comb had two concentric circles of capped cells, enclosing pupating larvæ and pupæ. The open cells contained eggs and young larvæ of different sizes. Undoubtedly all the brood in this comb represented workers of *diabolica*. The lower comb (Fig. 1) had a single circle of 20 pupæ of *diabolica* on half its area, while the center of the other half was occupied by a clearly defined cluster of 11 very large, elongate cells, each containing a conspicuously large larva. These cells are marked with white crosses in the figure. The remaining cells were very small and short and contained eggs and very young larvæ. Evidently all or nearly all the brood, except the 11 large

larvæ belonged to *diabolica*. These large larvæ, which were nearly ready to pupate, must have belonged to *arctica*, and were probably females. That they had been abundantly fed by the *diabolica* workers and their development favored beyond that of the remaining larvæ was evident from a glance at the two combs. Examination of the two queens, which were of the same size, showed that their wings were mutilated. The apical halves of both wings of the *arctica* queen on the right side had been bitten off. As both queens were still fresh when found in the nest on the morning of July 8 (the *diabolica* queen, when stimulated, still moved her tarsi!) we may infer that both were living together in the nest, though probably not on the best of terms, that the *arctica* queen had probably entered the nest just as the workers were beginning to build the second comb and had oviposited in 11 of its cells, and that the resulting larvæ were being actively fed by the *diabolica* workers, because the parasite's wings were too much mutilated to permit her to leave the nest and forage.

2. On June 29, the junior author killed a colony of *diabolica* which had its nest in the hay-scales of the State Antitoxin Laboratory on the grounds of the Bussey Institution. It was younger than the preceding, had one comb and only a few cells of a second, and contained only a small number of *diabolica* workers and an *arctica* queen. Since the colony was captured during the day, most of the *diabolica* workers were probably out foraging, and the absence of the *diabolica* queen may, perhaps, be accounted for on the same supposition.

3. August 4, the junior author took in the Arnold Arboretum a nest of *diabolica* containing three recently emerged males of *arctica*. In the same nest were about a dozen large larvæ and two or three pupæ, evidently queens, though whether of *diabolica* or *arctica* was not determined, as they were unpigmented. In all probability, however, they belonged to *arctica*. The presence of worker larvæ and pupæ indicated that the queens of both species were in the colony at about the same time (that is, if the time for development of *diabolica* workers is about the same as that required for the *arctica* males), and that at least one of the queens had been in the nest very recently was indicated by the numerous eggs, although these might, of course, have been laid by the workers.

During the entire summer we sought carefully for additional nests of *diabolica* infested with *arctica,* but none was found. At Colebrook the males of *arctica* were not uncommon on the flowers of *Spriæa salicifolia* and *Pastinaca sativa,* usually during the morning or late afternoon hours in three different localities where infested colonies of *diabolica* must have been present but could not be located. The first of these males was captured as early as July 16, and a few were taken every few days throughout the remainder of July and the first two weeks of August. Thereafter the species seemed to have disappeared, though in previous years a few males and females were captured as late as September 1. No males of *V. consobrina* were seen on flowers till July 31, and virgin females and males of *diabolica* did not appear till later (August 20 to 22), and soon afterwards disappeared. It would seem, therefore, that the early emergence and long flying period of the *arctica* males is an adaptation to insuring the fecundation of the much less numerous females, an adaptation the more necessary because the species is very rare most summers, when the host species, too, is less abundant.

The foregoing observations have an important bearing on what has been learned concerning *V. austriaca.* This wasp, which also lacks a worker caste, has long been known in Europe, where it ranges from Ireland to Russia, with a marked preference for mountains up to an altitude of 5500 feet. It seems also to occur in Palearctic Asia. Recently Bequaert (1916) took two females of *austriaca* at Fort Lee, New Jersey, opposite New York City, and recorded a specimen taken by Prof. J. S. Hine on the same day (July 16) on Staten Island. More recently (1918) Sladen has taken *austriaca* at Ottawa and Chelsea, Quebec (mid-June), and at Winnipeg and Kaslo, British Columbia (mid-July), and Bequaert (1920), cites specimens from Savonoski, Alaska (July), Mt. Hood, Oregon (G. P. Engelhardt Coll.), and Beaver Mouth, Selkirk Mountains, British Columbia (J. C. Bradley Coll.). In Europe this wasp has been taken in the nests of *V. rufa* and has been regarded as a parasite of the latter by Morawitz (1864), Schmiedeknecht (1881), Robson (1898), Saunders (1903), Sharp (1893), Pérez (1910), and Bequaert. Carpented and Pack-Beresford (1903) have published a careful account of an *austriaca-rufa*

colony taken in Ireland. They show that the two species are very closely related taxonomically, and infer that "the old *austriaca* queen was the foundress of the nest and that both the *rufa* and *austriaca* are her offspring." The evidence with which they endeavor to support this inference seems to us to be very inconclusive. It is indeed surprising that such accomplished entomologists should have failed to take account of the habits of other parasitic Aculeata, such as *Psothyrus* and the workerless ants, which are all so much better known than the wasps they werestudying.

The occurrence of *austriaca* in the vicinity of New York City and in British America and Alaska, at once raises the question as to its American host, since *rufa* is not known to occur on this side of the Atlantic. Bequaert surmises that *consobrina* may be the American host, and maintains that this wasp, "although very different in coloration, is very probably the American rase or subspecies of *Vespa rufa* L." If this proves to be the case, we should have the short-cheeked, black and yellow *austriaca* living with the short-cheeked, blach and white *consobrina,* just as our long-cheeked, black and white *arctica* lives with the long-cheeked, black and yellow *diabolica.*

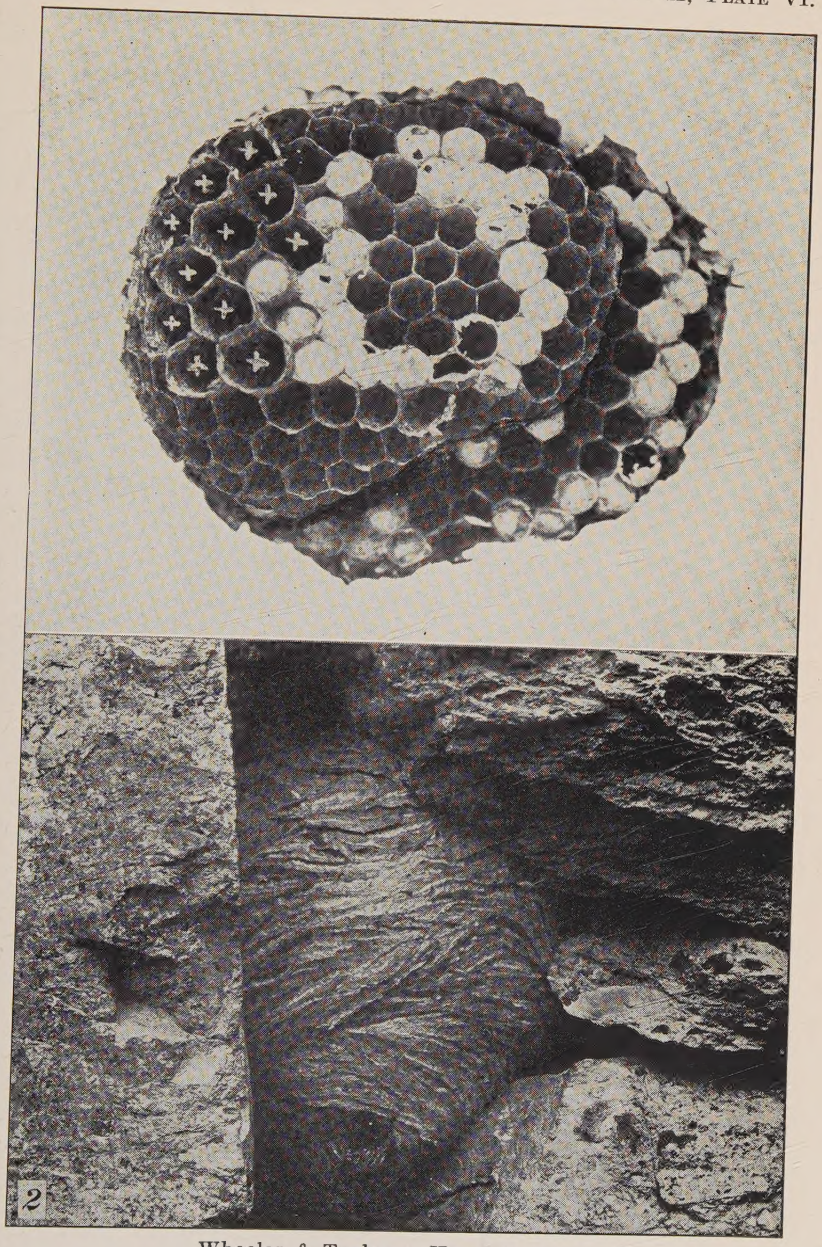
The dates of flight of male and female *austriaca* and *rufa,* carefully recorded by British entomologists (Carpenter and Pack-Beresford and Evans (1903)), indicate that the *austriaca* queens issue from hibernation later in the spring than the nest-founding *rufa* queens. The same is probably also true of *arctica* as compared with *diabolica.* Hence the parasitic queens, when they first appear in the spring, find the host nests already well-established and containing a worker personnel ready to nurse the parasitic brood. The parasitic *Psithyri* show the same tendency to enter the *Bombus* colonies only after their first batch of workers has emerged (Sladen, 1912), and the parasitic ants take a similar advantage of their host species.

The presence of both host and parasitic queens in the *arctica-diabolica* nest examined by the senior author at Colebrook, raises the question as to the probable eventual fate of the host queen in infested nests. In the various cases of the mixed colonies among ants the host queen is soon eliminated, and, according to Sladen (1912), the same rule applies to the *Bombus* queens of colonies

invaded by *Psithyrus* and to the queen of *B. terrestris lucorum* when its nest is invaded by the queen of *B. terrestris virginalis*.[1] Had the Colebrook *arctica-diabolica* colony, which was still young when asphyxiated, been permitted to continue its growth and development, the *diabolica* queen might, of course, have been eliminated. This would, indeed, seem probable, if we may judge from the observations of Robson and Carpenter and Pack-Beresford on *austriaca-rufa* colonies, which were well-developed when examined. The colony observed by Robson had no *rufa* queen, but must have been founded by one, since typical *rufa* males were present. He saw the *rufa* workers dragging out of the nest the decapitated and mutilated carcass of an *austriaca queen,* presumably after her brood had been reared by the *rufa* workers. Thus it would seem that in this colony the host-queen had been killed either by her own workers or by the parasitic queen, and that the latter had been killed by the *rufa* workers or had died a natural death in the nest after completing her life-work. Carpenter and Pack-Beresford give a detailed census of their *austriaca-rufa* colony. It contained an old *austriaca* but no *rufa* queen, besides many males and three pupal queens of *austriaca*. In this case also, the host queen seems to have been eliminated earlier in the season.

The absence of the host-queen from nests infested by the parasitic wasps, as in the nests of *austriaca-rufa* just considered and the two *arctica-diabolica* nests found by the junior author, may be due, nevertheless, to quite other causes. Desertion of the nest by its foundress, even after brood is present, or her destruction while foraging, may leave the colony motherless and open to invasion by parasitic queens. Janet (1903) has even observel the invasion of a motherless *V. crabro* nest by a strange *crabro* queen, and her adoption by the workers. Both Janet and Marchal (1896) have failed to find the queen in several nests of this wasp, and the latter shows that in the case of *V. media* the queen is so short-lived that she completes oviposition by the beginning of August and disappears soon afterwards. The development of *media* colonies is, therefore, considerably accelerated as compared with the colonies

[1] This rule does not seem to apply to some of our American Psithyrus-Bombus colonies, to judge from the very interesting, unpublished observations made by Mr. O. E. Plath at the Bussey Institution during the past summer.



Wheeler & Taylor — *Vespa diabolica*

Fig. 1. Combs from nest of **Vespa diabolica** taken by the senior author at Colebrook, Conn. The white croses at the left mark the large cells occupied by the larvæ of the parasite, **Vespa arctica.** Natural size.

Fig. 2. Typical nest of **Vespa diabolica.** about 2/5 natural size.

Fig. 3. Nest built by workers of **Vespa diabolica.** Natural size.

of *V. germanica* and *communis,* in which the mother queen is often found as late as the last of September or early October.

Perhaps the *diabolica queen* may resemble the *crabro* queen in her tendency to desert an incipient nest and found another, or perhaps, as a rule, she may desert her nest as soon as it is invaded by an *arctica* queen. That she is short-lived, like the queen of *media,* seems to be indicated by the following observations on uninfested nests:

July 21, the senior author asphyxiated a *diabolica* colony which was nesting very near the ground at the base of a cluster of golden-rods in a deserted pasture. The nest was well-developed, with two large combs and a very small, four-celled third comb. There were 76 workers but no queen, although her presence might have been expected, since the colony was asphyxiated after dark.

August 27, the senior author found depending from the ceiling of a porch a small abandoned *diabolica* nest. It had only a single small comb, about 3.5 cm. in diameter, containing some dead worker pupæ and small larvæ. A similar deserted nest was found earlier in the season attached to the limb of a tree.

Also on August 27 a large, well-developed *diabolica* nest was found under the roof of a water-tank. Two living workers were still clinging to the involucre, which contained three well-developed combs. There were a few living worker pupæ in the combs and a number of dead workers that had fallen from the nest. The males and virgin females had departed, so that the colony must have completed its development several days and possibly a few weeks before the first of September.

Of eight *diabolica* nests taken by the junior author before August 4, on the grounds of the Arnold Arboretum, only one contained an old queen, although in each case care was taken to secure the entire colony.

A flourishing colony of *V. diabolica* comprising 200 to 250 workers, also without a queen, was taken August 10. The apparently exclusive emergence of males from this colony, as a result of which there were scarcely 25 workers left in the nest by Sep-

tember 10, suggested that the queen might have been absent for some time before the earlier date.[1]

Of two *diabolica* nests taken September 14, one contained approximately 150 workers and 250 males, though the colony must have numbered fully a thousand during its prime. This nest had no queen, but in the other one killed the same day, along with 40 workers and 60 males, was a single virgin female, the last of a considerable number that the colony had produced.

Our observations on *V. arctica* and *diabolica,* though fragmentary, seem to justify the following conclusions:

1. The nest-founding queen of *V. diabolica,* like that of the European *media,* is rather short-lived, completing oviposition and perishing rather early in the season, probably not later than the middle or early part of August, at least during favorable summers.

2. There are some indications that the *diabolica* queen, like the *crabro* queen, has a tendency to desert her nest in an incipient stage and found another.

3. *V. arctica* is a permanent social parasite in the nest of *diabolica,* and her brood, consisting exclusively of males and fertile females, is reared by the *diabolica* workers.

4. The over-wintering queen of *arctica,* like that of *austriaca,* probably appears late in spring, at a time when the nests of the host-species are already established and contain enough workers to nurse her brood.

[1] In taking this nest at dusk the junior author failed to capture about a dozen workers which were still flying about, and which finally settled on the tree from which the nest had been cut. Deprived of their habitation, and even of the branch which supported it, these few workers were huddled together the next evening at a place remote from the original position of the nest. Closer observation revealed that they had already attached bits of newly-made paper to the bark of the tree. It was about this paper that the workers were congregated. By the end of the second day the wasps had suspended a single cell from a strong filament of paper after the manner of a queen in founding her nest in the spring, and in a few more days the structure had begun to assume the proportions of a normal nest. On September 10 it was about the size of a hen's egg and there were still two or three workers defending it (Fig. 3). Six days later this nest was found torn open, apparently by a predator, perhaps a bird, which had robbed it of whatever it might have contained, thereby preventing further observation.

The construction of nests by workers of European species of wasps has been observed by several authors, notably Janet (1903), who describes three new nests built successively by workers of the same colony. Other accounts are given by Ormerod (1859), Stone (1860), von Siebold (1871), Kristof (1878) and Marchal (1896).

5. The fate of the host queen in such nests is unknown. Whether she voluntarily deserts the nest soon after the parasite enters or is killed by the latter or by her own workers, or whether the parasitic queen has a tendency to enter young motherless nests of the host species, remains to be determind. That both queens may occasionally live side by side for some time, would seem to be demonstrated by the colony examined by the senior author.

6. From what is known of *V. arctica* and *austriaca* we may conclude that these workerless wasps have essentially the same relations to their host-colonies as the parasitic *Psithyri* and workerless ants (*Anergates,* etc.).

Bibliography.

1916. *Bequaert, J.* On the Occurrence of *Vespa austriaca* Panzer in the Northeastern United States. Bull. Brooklyn Ent. Soc. 11, 1896, pp. 101-107.

1920. *Bequaert, J.* Bees and Wasps. Scientific Results of the Katmai Expedition of the National Geographic Society. Ohio Journ. Sci. 20, 1920, pp. 292-297.

1903-1905. *du Buysson, R.* Monographie des Guêpes ou Vespa. Ann. Soc. Ent. France 72, 1903, pp. 260-288; 73 (1904), 1905, pp. 485-556, 565-634.

1903. *Carpenter, G. H. and Pack-Beresford, D. R.* The Relationship of *Vespa austriaca* to *Vespa rufa.* Ent. Month. Mag. (2) 14, 1903, pp. 230-242, 1 pl.

1903. *Evans, W.* *Vespa austriaca* and *V. rufa* in Scotland. Ent. Month. Mag. (2) 14, 1903, pp. 299, 300.

1908. *Fletcher, J.* *Vespa borealis* an Inquiline? Ann. Ent. Soc. Amer. 1, 1908, p. 30; Psyche 15, 1908, p. 16.

1903. *Janet, Ch.* Observations sur les Guêpes. Paris, C. Naud. 1903.

1878. *Kristof, L. J.* Ueber einheimische, geselliglebende Wespen und ihren Nestbau. Mitt. Naturw. Ver. Steiermark, 1878, p. 38.

1896. *Marchal, P.* La Reproduction et l'Evolution des Guêpes Sociales. Arch. Zool. Expér. et Gén. (3) 4, 1896, pp. 1-100, 6 figs.

1864. *Morawitz, F.* Ueber *Vespa austriaca* Panz. und drei neue Bienen. Bull. Soc. Imp. Nat. Moscow 37, 1864, pp. 439-449.

1859. *Ormerod, E. L.* Contributions to the Natural History of the British Vespidæ. The Zoologist 17, 1859, pp. 6641-6655.

1910. *Pérez, J.* Notes sur les Vespidès. Actes Soc. Linn. Bordeaux 44, 1910, pp. 1-20.

1898. *Robson, J. E.* *Vespa austriaca,* a Cuckoo-Wasp. Science Gossip (N. S.) 5, 1898, pp. 69-73.

1903. *Saunders, E.* On the Relationship of Aculeate Inquilines and their Hosts. Ent. Month. Mag. (2) 14, 1903, pp. 272-274.

1881. *Schmiedeknecht, O.* Ueber einige deutsche Vespa-Arten. Ent. Nachricht. 7, 1881, pp. 313-318.

1879. *von Siebold, C. Th. E.* Beiträge zur Parthenogenesis der Arthropoden. Engelmann, Leipzig, 1871.

1899. *Sladen, F. W. L.* Bombi in Captivity and Habits of Psithyrus. Ent. Month. Mag. 35, 1899, pp. 230-234.

1912. *Sladen, F. W. L.* The Humble-Bee, its Life-History and How to Domesticate it. Macmillan & Co., London, 1912.

1918. *Sladen, F. W. L.* The Genus Vespa in Canada. Ottawa Naturalist 32, 1918, pp. 71-72.

1860. *Stone, S.* Facts connected with the History of a Wasp's Nest. Trans. Ent. Soc. London (2) 6, 1860, pp. 86-87.

1916. *Viereck, H.* Guide to the Insects of Connecticut. Part III. The Hymenoptera, or Wasp-like Insects of Connecticut. Bull. No. 22, State Geol. and Nat. Hist. Survey of Connecticut. 1916.

1919. *Wheeler, W. M.* The Parasitic Aculeata, a Study in Evolution. Proc. Amer. Phil Soc. 58, 1919, pp. 1-40.

NOTES ON DEFENSIVE SCENT GLANDS OF CERTAIN COLEOPTERA.

By J. S. Wade,

Scientific Assistant, Bureau of Entomology.
Washington, D. C.

The attention of the writer was first directed to the functions of defensive or repugnatorial scent glands in certain Coleoptera during the study some time ago of the biology of some of the more common species of Coleoptera belonging to the Tenebrionid tribe Eleodini, inhabiting portions of the central Great Plains region. Later, a growing interest led to closer field observation and to the examination, as opportunity offered, of available literature on the subject. The notes which follow are intended merely to supplement data already published, to which reference is made.

It is obvious to anyone at all familiar with insect life, that the degree of sensitiveness and response in insects to certain external phenomena is enormously greater than in vertebrates, and that their organs of sense are developed accordingly. It always has been a cause for wonder to human beings as to the means by which the various lower animals recognize, distinguish and communicate with each other. Although we know very little about the senses of the lower animals, it long has been known that such senses as sight or touch are not nearly so important to insects as to us. We know that insects actually do distinguish and communicate with each other, or are attracted or repelled by each other, and as the means of communication are not known to use, may we not safely assume that such is brought about through factors, the existence of which is not yet recognized or understood? Packard (1898) has called attention to the ease and rapidity with which exceedingly delicate, attenuated, and highly volatile odors unknown to us are perceptible to insects. McIndoo (1917) has suggested the presence of a chemical sense or senses, somewhat comparable to our olfactory sense, which receives and transmits stimuli in a way somewhat like that of odors, and has ably discussed the results of observations and experiments upon certain insects, and has given a short historical review of the literature on the subject. In fact,

the subject as a whole in its relation to animal ecology makes a powerful appeal to the human imagination.

It has been well understood that the presence of defensive or repugnatorial scent glands in certain insects exists in direct adaptation to the needs and habits of their owners and in close response to their environment; also that such glands are of very frequent occurrence and with much variation as to position, form, and function; and that their presence is of value to the insect for repellent, defensive, and warning purposes. These eversible glands most frequently occur in the form of simple hypodermic pouches from which can be emitted, when desired, varying amounts of an odorous spray capable of permeating throughout considerable surrounding atmosphere. Biologically speaking, the principle involved in such cases, though often modified, is practically identical with that of the mephitic, sulphuretted, oil-like fluid ejected by the skunks. Thus far anal glands are known to be present in the following families of Coleoptera: Cicindelidæ, Carabidæ, Dytiscidæ, Gyrinidæ, Staphylinidæ, Silphidæ, and Tenebrionidæ. The blood itself serves as a repellent fluid in the Meloidæ, and in the Coccinellidæ and Lampyridæ, and it issues from a pore at the end of femur as a yellowish fluid. The cantharidine in the blood of some species of Meloidæ, commonly known as "Spanish Fly," forms an especially caustic protection against birds, predaceous insects and reptiles. A number of the Carabidæ eject from a pair of anal glands a pungent, acid, and often corrosive fluid, staining the hands a rust-red color, and in *Galerita janus* Fab., the "Bombardier beetles" (*Brachinus*), and others, it "explodes" or volatilizes as soon as it comes in contact with the air, and the discharge and puff of vapor is accompanied by an audible report. This occurrence may be repeated over and over again in succession at frequent intervals. Westwood (1839) has recorded that specimens of a *Brachinus* of large size from South America, when captured "immediately began to play off their artillery, burning and staining the flesh to such a degree that only a few specimens could be captured with the naked hand, leaving a mark which remained for a considerable time." The odor of rose or hyacinth given out by certain Cicindelidæ, or the fragrance exhaled by the European *Aromia moschata,* are secretions probably formed by similar glands.

The larvæ of certain Coleoptera, notably in the Chrysomelidæ, also are supplied with eversible hypodermal glands of various kinds. Folsom (1906) states that "the larvæ of *Melasoma lapponicum* evert numerous paired vesicles which emit a peculiar odor."

Packard has divided all scent-producing organs into repugnatorial and alluring organs, and a third class including those for recognition only, has been suggested by McIndoo, who has directed attention to the fact that it often is impossible to determine purposes for which such organs are used.

During the summer and fall of 1914 and the spring of 1915 collections of various species of adults of Eleodiini for breeding purposes, aggregating several thousand specimens, were made by the writer over a considerable area in Western Kansas and Western Nebraska, and during this period there were many opportunities for making observations relative to a curious habit possessed by many members of that tribe. When disturbed, many of them have a habit of standing on their anterior and middle legs, elevating the abdomen to its utmost height, appearing at times fairly to stand upon their heads, and spurting sidewise right and left from their eversible repugnatorial glands, a persistently malodorous liquid having a peculiar penetrant odor, and capable, when brought into accidental contact with the skin of the human hand, of making a stain almost impossible to wash off, and the odor of which varies in intensity with some of the species.

"The smell of the glandular secretions," says Gissler (1879), "is to my knowledge incomparable to anything else." The glands of the species examined, *Eleodes gigantea* Mann., are in both sexes embedded in the fat bodies on each side of the intestinal tract, and consist of two reddish-brown organs about 6 mm. in length, somewhat cylindrical at one end and roughly flattened at the other. Gissler has records concerning the fluid that "When the secretion is spurted on a glass slide, it solidifies within a few seconds, forming an orange-colored magma of minute crystals, in other cases it only partially crystallizes, and in others it remains entirely liquid. It is in all cases of an acid reaction, and of an intensely penetrant odor, causing the eye to lachrymate. It is soluble in water, alcohol and ether. Boiled with concentrated sulphuric acid and alcohol an ethereal aromatic vapor is produced, indicating the

presence of one or more organic acids. . . . Having tested for valerianic acid in the usual way with neutralized soda solution upon sesquichloride of iron, no red precipitate of valerianate of iron was formed, nor have I obtained a bluish-white opalescent liquid of butyrate of copper on adding acetate of copper. Uric acid was also found to be absent, on treating with nitric acid and ammonia in the usual way; neither could I detect formic or acetic acid, nor did boiling with caustic soda liberate ammonia. A few drops of the secretion, put on a piece of dry caustic soda, turned at first dark green, became in a few seconds dirty brown, and cleared up to a brownish red after several hours."

It was interesting to note that the quantity of the secretion voided varies noticeably with the different species under observation, both under field and under laboratory conditions, and some of the species, notably *Eleodes tricostata* Say, undoubtedly have the habit of erecting the abdomen in a threatening manner when approached, though no secretion may be voided. Such species undoubtedly find protection through imitation of the threatening movements of their more formidable associates. Two of the characteristics of the Eleodes are their slowness of movement, and their habit of coming out of their hiding places about sunset for feeding purposes, and their presence is readily noticed on the bare sandy plains by birds, skunks, and other enemies, hence their protective secretion, or, in the absence of this, their threatening maneuvers are no doubt of highest value to them.

References.

1839. *Westwood, J. O.* Modern classification of insects, Vol. 1, pp. 75-76.

1879. *Gissler, C. F.* On the Repugnatorial Glands of Eleodes. Psyche, Vol. 2, pp. 209-210, inc.

1882. *Dimmock, G.* On some glands which open externally on insects. Psyche, Vol. III, pp. 387-401.

1884. *Williston, S. W.* Protective Secretions of species of Eleodes. Psyche, Vol. IV, pp. 168-169 inc.

1895. *Packard, A. S.* The Eversible repugnatorial Scent Glands of Insects. Jour. N. Y. Ent. Soc., Vol. III, pp. 110-127.

1896. *Packard, A. S.* Literature on defensive or repugnatorial glands of insects. Jour. N. Y. Ent. Soc., Vol. IV, pp. 26-32 inc.

1898. *Packard, A. S.* A Text-book of Entomology, pp. 368 to 390 inc.

1906. *Melander, A. L. and Brues C. T.* The Chemical Nature of some Insect Secretions. Bull. Wis. Nat. Hist. Soc. Vol. 4, pp. 22-36.

1906. *Folsom, J. W.* Entomology with special reference to its biological and economic phases. Pp. 81-82 inc.

1917. *McIndoo, N. E.* Recognition Among Insects. Smith. Misc. Colls., Vol. 68, No. 2, pp. 1-78.

A NEW SPECIES OF HETEROCAMPA (LEP., NOTODONTIDÆ.)

By Wm. Barnes, M. D. and A. W. Lindsey, Ph. D.
Decatur, Ill.

Heterocampa amanda n. sp.

Head, thorax and abdomen light gray or brownish gray to dark gray. Tufts and tips of patagia darker. Pectinations of ♂ antennæ long, gray-brown; shaft with some light gray scales.

Primaries gray, the costa powdered with whitish scales and the veins in part somewhat darker than the ground color. Within the basal area, below Cu_2, and beyond the cell there are sometimes paler, somewhat brownish areas. Basal line geminate, the outer black, the inner gray, and the included space buff. T. a. line geminate, faint, outwardly convex between the veins. This line is oblique, almost reaching the middle of the inner margin, and is slightly curved. T. p. line similar but with scallops reversed and much slighter. This line is almost upright, but is slightly concave outwardly beyond cell and inside of Cu_1, leaving the usual square projection between Cu_1 and M_3. The s. t. line is made up of two blackish shades, one almost straight from near apex to M_3, the other beginning outside of the first on M_3, running thence to Cu_2, and then curving outward toward the anal angle. Both are followed by vague slender whitish lines. There is a blackish terminal line, sometimes cut by white on the veins, and the fringes are concolorous with the wing, but with blackish at the veins. Cell terminated by a curved blackish line. Secondaries white in male, the costa, outer margin (very slenderly), terminal quarter and sometimes a short median portion of veins marked with gray-brown. Fringes more or less grayish, darker at the veins. In the female the secondaries are more gray-brown with a variably definite band filling the terminal third and a less strongly marked median shade and discal spot. Fringes grayish white, dark at the veins. Under surface white in the male, the secondaries marked much as above and the primaries darker toward costa and apex, with only the markings of the fringes, a discal bar, and sometimes a paler terminal area visible. In the female this surface is much darker, as would be expected. The primaries are otherwise similar

to those of the male, while the secondaries have a terminal powdery whitish area, preceded by a broad vague transverse shade and then by a slender median shade, both of which lose their identity toward the costa. The discal bar is present. Expanse 35 to 45 mm., the sexes similar.

Described from ten specimens in coll. Barnes. Holotype ♂, 3 paratypes ♂ and one paratype ♀, from the Hualapai Mts., Mohave Co., Ariz., May. One paratype ♂ from the Planet Mine, Bill Williams R., Yuma Co., Ariz., and four paratypes ♀ from Mohave Co., Aug. In addition we have specimens from Yavapai and Cochise Counties, Ariz.

We place this species after *umbrata* Wlk. and its forms, though it is not closely related. Its superficial appearance suggests *Fentonia miranda* Dyar, but it is a true *Heterocampa* and this resemblance is only general.

NOTE ON THE SURGONOPODS OF CERTAIN MECOPTERA AND NEUROPTERA.

By G. C. Crampton.

Through the kindness of Mr. A. N. Caudell, I have recently been able to examine a specimen of the interesting Mecopteron *Merope tuber,* preserved in alcohol. Since the specimen was preserved in fluid, this permitted the moving of the parts without danger of breaking them, and enabled me to determine that the parts which I formerly considered to be the dorsal penis valves (i. e., the parts labeled "dv" in Fig. 24, Plate III, of Psyche, Vol. 25, 1918), from an examination of a dried specimen of *Merope* in the Cambridge museum, are in reality the surgonopods, or lateral appendages of the tenth abdominal segment. It would also appear that certain of the structures called gonopods in the Neuroptera shown in Figs. 14, 12, etc., of the article in question, are likewise homologous with the surgonopods, as I have pointed out in a paper which will later be published, dealing with the terminal structures of insects in general.

NOTES ON *ORCHESTES RUFIPES* LEC., IN NEW JERSEY.

By Harry B. Weiss and Ralph B. Lott,
New Brunswick, N. J.

According to Blatchley and Leng[1] this weevil is known to occur in New York, Vermont, Massachusetts, Newfoundland and Quebec. At Batavia, N. Y., according to H. H. Knight, it was abundant on the shining willow *Salix lucida,* the adults feeding on the leaves, July 1 to 15, the larvæ mining the leaves in August and September; other species of willow in the same locality were not infested. Gibson[2] states that in Ontario an outbreak of *rufipes* occurred locally on willow toward the end of May and during the first half of June at the Experimental Farm; beetles were first noticed on the laurel-leaved willow *Salix pentandra* on May 31, and were quite numerous by June 15, and their work noticeable. In one leaf, two and one quarter inches long and one inch wide, 329 feeding holes were counted. The species is not recorded in Smith's List of the Insects of New Jersey, although it is known to occur on *Salix lucida* and also on black willow *Salix nigra,* at Rutherford, where all of the observations recorded in this paper were made.

In New Jersey the beetles go into hibernation about the latter part of September and first of October, selecting such places as under loose bark, in partly dead wood, in dry stumps of limbs, etc. Here they may be found in colonies of varying numbers, depending on the size of their hibernation quarters. If suitable weather prevails a few beetles will emerge about the middle of April or even before and can be found crawling over the bark. Feeding soon takes places and by the last of April and first of May noticeable damage is being done to the leaves. Even at this early date many leaves will be brown and dry if the beetles are numerous. Feeding continues all during May, interrupted by copulation during the latter half of this month. Eggs are deposited during the last of May and first part of June, and by the middle of June hatching is under way and small mines are visible. By the last of June the mines, together with the larvæ, are good-sized and much in

[1] Rhynch. N. E. Amer., p. 282, 1916.
[2] 41st Ann. Rept. Ent. Soc. Ont., p. 15, 1910.

evidence. Practically all of the adults disappear by the middle of June. The mining of the foliage continues until about the end of the first week of July, at which time most of the larvæ are full grown and pupation is starting. This takes place within the mine, requiring about a week or ten days. By the middle of July many beetles are out and by the last of July the entire brood is in evidence, feeding on such green foliage as escaped the ravages of the larvæ and the hibernating brood of beetles. Feeding continues until cool weather forces the beetles to seek winter quarters.

As has been stated before, a noticeable browning of the foliage starts about the last of April or first of May. As the feeding increases so does the injury, and by the time the mines are starting much of the foliage is brown and dead. The larvæ complete the destructive work, and by the end of July infested trees have the appearance of having been swept by fire.

The adult eats a hole usually through the lower epidermis and then consumes the tissue and juices between the upper and lower epidermis for a short distance around the original opening. This results in a little circular or oval hollow area in the leaf along the inner edge of which is the opening through which the beak was inserted. Later, the lower epidermis over the hollow space dries and falls off. This leaves a depression on the under surface. Still later the upper epidermis over the eaten portion becomes brown, dries and cracks, and this may result in a hole through the leaf. The injury really consists of a skeletonizing of the leaf from the lower surface, but it is not accomplished directly as in the case of most skeletonizing by other species. In severe infestations the feeding punctures are so close that the entire leaf is covered by them.

The eggs are inserted singly anywhere under the lower epidermis in irregular oval cavities, which resemble feeding punctures. The tissue above and below the egg becomes brownish. The female cuts nearly a complete circular slit in the lower epidermis, leaving enough tissue for a hinge. This circular flap is pushed to one side and an irregular oval area cleaned out. This results in a somewhat oval cavity with the opening at one end. The egg is then inserted and the flap closed. Eggs were found in young and old leaves, even when they were considerably injurd by feeding.

The completed mines are blotch-like and usually extend from the midrib to the edge of the leaf, occupying from one-sixth to one-fourth of the entire leaf surface. They are visible plainest from the upper surface, where they appear as brownish, discolored, dead areas. As a rule, there is only one larva in a mine, but in many cases the mines merge, so that the entire leaf consists of a solid mine containing numerous larvæ. Many leaves contained from seven to twenty-two small mines. On account of the merging of some of these, and on account of the death of some of the partly grown larvæ, only from three to five completed large mines were found in most of the leaves at the end of the season.

Egg. Length, 0.32 mm. Width across middle portion, 0.2 mm. Oval, ends broadly rounded; translucent, somewhat whitish.

Larva. Length about 3.7 mm. Width of thorax about 1 mm. Form subcylindrical, thoracic segments wider than abdominal ones, body tapering slightly from thorax to posterior portion of abdomen. Segentation distinct. Whitish except for a median dorsal and ventral row of abdominal spots, the head and thoracic shield which are brownish (young larvæ is greenish-white, translucent). Head small, subcircular, sparsely hairy; collum absent; epicranial halves separated dorsally by faint median suture; front large, triangular; gula membraneous, indistinct; mouth parts small. Labrum triangular with truncate apex, anterior edge fringed with chitinous hairs. Mandibles broad across basal three-fourths, apical fourth narrow, acute, entire. Labium transverse with mentum and submentum fused, indistinct, anterior edge arcuate. Maxilla fused with labium to near apex, lacinia simple fringed with chitinous hairs on inner distal surface; maxillary palpi two-jointed. Thoracic shield transverse, covering most of prothoracic dorsum. Mesothorax and metathorax wider than all other segments. Sides of thoracic and abdominal segments produced laterally. True legs absent. Cerci absent. Anal segment wart-like. Body hairs short and sparse, more apparent laterally.

Pupa. Length about 2.6 mm. Oval, white to brownish black. Posterior dorsal portion of prothorax bearing prominent chitinized hairs, a transverse row of ten arising from dark, tuberculate bases, five on either side of middle. Dorsal posterior portion of abdomen terminated by a pair of upward-directed, stocky tubercles, tipped

with sharp chitinous points. Dorsal surface of abdomen and metathorax bearing a few minute hairs. Head and snout bearing several chitinized hairs. A single prominent chitinized hair arising from distal portion of each femur. Wing cases with longitudinal striæ. Each abdominal segment with a pair of dorsal foveolæ, one on either side of the middle.

Adult. *Orchestes rufipes.* This was described by LeConte in 1876 (Proc. Am. Phil. Soc. Vol. XV, No. 96, p. 208) from Vermont specimens. The original description follows:

"Black, very thinly pubescent, with fine whitish hairs; beak finely punctured, head punctured, front narrow but distinct; prothorax finely punctured; elytra oval, rather flattened, deeply striate, interspaces rugosely punctulate. Antennæ and legs yellow, hind thighs dusky, very slightly incrassated; funicle six-jointed, second joint scarcely longer than the third; thighs not toothed; claws broadly appendiculate. Length 2 mm.; .08 inch."

Should it be desirable to control this insect, spraying with arsenate of lead is recommended. The poison should be applied to the lower leaf surfaces during the last of April or first of May. On account of the length of time during which the adults feed before depositing eggs, almost complete killing should be accomplished.

NOTES ON NOCTUIDÆ WITH DESCRIPTIONS OF SOME NEW SPECIES (LEP.).

By Wm. M. Barnes, M. D. and A. W. Lindsey, Ph. D.,
Decatur, Illinois.

Agrotinæ.

Prochloridea madonna n. sp.

Head and thorax clothed with a mixture of gray, whitish and mixed hairs and scales. Palpi dark gray outside, whitish within. Antennæ ciliate in the ♂. Abdomen shining grayish, touched with clay yellow.

Primaries with vestiture mixed black, whitish and gray scales in about equal parts, with two broad, light brown stripes radiating from base of cell toward apex and oval angle respectively. These stripes are sometimes scarcely visible, but are usually quite evident. T. a. line irregular, oblique, with a prominent tooth in costal region, one on cubital stem and one on anal vein; usually very vague but someties well marked; single, pale gray, marked on costa by one or two blackish dots. T. p. line also pale gray, preceded by a fine dark shade, outwardly curved around end of cell and rather even except on this bend, where it is finely dentate; near the inner margin it curves basad. Orbicular and reniform very vague, sometimes evident as dark central spots surrounded by pale margins. In the terminal space there is a variable number of short longitudinal black dashes between the veins. Fringes with alternating light and dark patches of a "pepper and salt" appearance similar to the primaries. Secondaries white with a slight sprinkling of dark scales in the outer third, usually localized on the veins, and a similar terminal line. Fringes white with a few dark scales. Female similar. Expanse 31 to 33 mm.

Holotype ♂, allotype, 13 paratypes ♂ and 3 paratypes ♀ from Olancha, Inyo Co., Cal., June 8-30, July, Aug., in coll. Barnes.

Madonna is smaller and more grayish than the three females in the type series of *modesta* B. & McD., and the median line of the secondaries is very rarely suggested. In spite of these differences we should not be surprised to find that it is only a race of the

older species. Unfortunately the lack of males of *modesta* prevents our checking their relationship by an examination of the genitalia.

Lygranthœcia meskeana and **rufimedia** Grt.

These species are treated as synonymous in Smith's "Synopsis of the North American Heliothinæ" (Trans. Am. Ent. Soc. X, 235) and the latter is regarded as an aberration of the former by Hampson (Cat. Lep. Phal. B. M. IV, 65). We have recently had reason to consider these species, and find that the shades of the upper surface are so variable as to be confusing. On the lower surface, however, the pale areas are decidedly yellowish in *rufimedia,* but whitish in *Meskeana.* This difference appears to occur irrespective of sex or locality, and seems to be the most convenient criterion for the separation of the two.

HADENINÆ.

Lasionycta perplexa Sm.

This species is listed in the genus *Lasiestra* Hampson, which is characterized in the original description as having thoracic vestiture of rough hair. *Lasionycta* Auriv., on the other hand, is said to possess thoracic vestiture of hair and hair-like scales. The vestiture of *perplexa* is distinctly scaly and much less rough than in the other North American species which we retain in *Lasiestra,* and we therefore advocate its transfer to *Lasionycta.*

Nephelodes mendica n. sp.

Head and thorax with pinkish-brown vestiture, the hairs pale tipped. Abdomen more grayish with the usual clay-colored tinge.

Primaries similar, sprinkled with blackish scales along the veins. Median area filled with brown from radial stem to inner margin. T. A. line pale, oblique, vague. T. P. line sinuate, geminate, formed of a rather broad pale line preceded by a fine, dark shade, and very slightly crenulate. Orbicular and reniform variable in shade, in the holotype pale, with a few darker scales in the center. In one of the paratypes these spots are scarcely differentiated, except the outer part of the reniform, which is pale, and in the other they are concolorous, margined with darker scales. Median shade dark, vague. S. T. line faintly indicated by a contrasting dark shade, which is most noticeable in the costal region. Fringes

concolorous, with paler bases. One paratype is much paler and more evenly colored than the other specimens and has a series of terminal dark dashes. Secondaries white, veins darker; terminal area sparsely sprinkled with dark scales; fringes white. Expanse about 40 mm.

Three males from Eureka, Utah (Spalding): holotype Sept. 21, paratype Sept. 21, and paratype Aug. 24, in coll. Barnes.

This species appears to be most closely related to *pectinata,* and we place it at the head of the genus. The peculiar shade of brown, less smooth vestiture of primaries, and white secondaries, separate it readily from *pectinata.*

Acronyctinæ.

Langona, gen. nov.

Proboscis aborted; palpi small, weak, slender, slightly drooping, not quite reaching front. Front smooth, without projection; eyes large, rounded. Antennæ of male bipectinate, the pectinations ciliate; of female lightly ciliated. Head and thorax clothed with scales with a few hairs intermixed, metathorax with a large tuft of spatulate scales. Pro- and mesothorax without tuft (?). Legs moderate; tibiæ without spines or claws. Abdomen without tufts. Primaries with costa long, nearly straight; apex rounded-acute, outer margin strongly oblique, bent at Cu, secondaries relatively small, apex broadly rounded; outer margin bent between Cu_1 and M_3; anal angle broadly rounded. Vein Cu_1 of primaries near end of cell; Cu_2 about 4/5 from base; R_4 and R_5 stalked, anastomosing with R_3, out of R_2, to form areole. Cu_1 and M_3 of secondaries contiguous at base; M_2 obsolescent, from middle of discocellulars; M_1 and R_5 short-stalked.

Type: *Langona grisescens* n. sp.

Langona grisescens n. sp.

Head badly rubbed in type; apparently clothed with gray scales. Thorax badly rubbed in ♀, slightly so in ♂'s; vestiture of pale gray scales tipped with blackish, and with a few hair-like scales of the same color. Metathoracic tuft of whitish scales with the broad tips blackish, shining. Abdomen with pale brownish-gray vestiture. Primaries with gray scales tipped with blackish-brown and sprinkled with white scales in costal and apical half, giving the

wing a hoary gray appearance. Transverse lines blackish; basal line from costa to anal vein. T. a. line oblique, bent outward before anal vein in the ♂, straight in the ♀; t. p. line bent outward below costa, where it is merged with a dark subapical shade, and more broadly in the median area, whence it curves inward to the inner margin, where it is followed by a small pale area. Subterminal area powdery gray; a fine, dark terminal line. Fringes concolorous. Reniform faintly indicated in all types and orbicular in ♂'s pale, with a darker edge. Secondaries powdery brownish-gray, paler at base. Fringes paler. Under surface of primaries even gray-brown with the sub-apical shade set off by some white powdering. Secondaries paler than above; terminal area and a discal spot darker. Expanse 24-27 mm.

Holotype ♂, Palmerlee, Ariz., allotype, S. W. Ariz., and paratype ♂, Hereford, Ariz., in coll. Barnes.

The species looks not unlike an Acopa, but is quite distinct from that genus.

Mominæ.

Although no members of this sub-family have yet been reported from our limits, we think that it must be accorded a place in our lists for the reception of Grote's genus *Trichocosmia* and both of the included species, *inornata* Grt. and *drasteroides* Smith. In both of these species the eyes are sparsely hairy and vein M_2 of the secondaries is very evidently nearer to M_3 than to M_1. They run to this subfamily in Hampson's key to the subfamilies of Noctuidæ (Cat. Lep. Phal. B. M. IV, 3 and 4).

ON *EUMENES ALLUAUDI* PEREZ, A PRECINCTIVE WASP OF THE SEYCHELLES (HYMENOPTERA).

By J. Bequaert,

American Museum of Natural History, New York City.

In my Catalogue of Ethiopian Diplopterous Wasps, published in 1918,[1] I have attempted to correlate the various described forms of African *Eumenes*. In many cases, where specimens were not available for study, my conclusions were based on such inferences as could be made from published accounts, and were therefore only tentative. *Eumenes alluaudi* J. Pérez,[2] for instance, I regarded at the time as one of the color variants of *Eumenes lepeleterii* Saussure, to which it was said to be related by the author of the species. Through the courtesy of Mr. A. S. Rohwer, I recently had opportunity to examine a series of specimens of *E. alluaudi* in the U. S. National Museum collection, and was surprised to find that this wasp is structurally very distinct from any of its congeners. Since it apparently is restricted to a very small range in the Seychelles and neighboring islands, and thus affords a typical illustration of the effects of oceanic isolation upon the appearance and preservation of specific characters, it may be useful to redescribe the form and to figure some of its most noteworthy peculiarities.

Female. Length (head+thorax+tergites 1+2) 21 mm.

Decidedly more slender than *E. maxillosus,* strikingly so in the abdomen. Head (Fig. 1*b*) from front view about as high as broad, due to the lengthening of the clypeus. Clypeus distinctly higher than broad; its apical free portion a little longer than its basal part and with more deeply concave sides than in *E. maxillosus;* its apical margin almost straight, slightly curved inward, with pronounced, but blunt lateral angles. Vertex without fovea. Eyes bare. Posterior ocelli about as far from each other as from the eyes. Mandibles shaped much as in *E. maxillosus;* long and slender, beak-like, the inner margin with three slight notches; near the base of the inner margin an indication of the raised fold which is so prominent in the male. Antennæ and mouth-

[1] Bull. American Mus. Nat. Hist., 39, 1918, pp. 274-283.
[2] Ann. Soc. Ent. France, 64, 1895, p. 206.

parts as in *E. maxillosus*. Shape and structure of thorax and legs also as in that species. Middle tibiæ with one spur. Abdomen more slender than in *E. maxillosus,* though of the same general shape. The basal, narrow portion of the petiole is fairly parallel-sided and about as long as, or but little shorter than, its apical, broadened part; the spiracles are prominent, placed a little beyond half the length of the petiole; the broadened, posterior portion

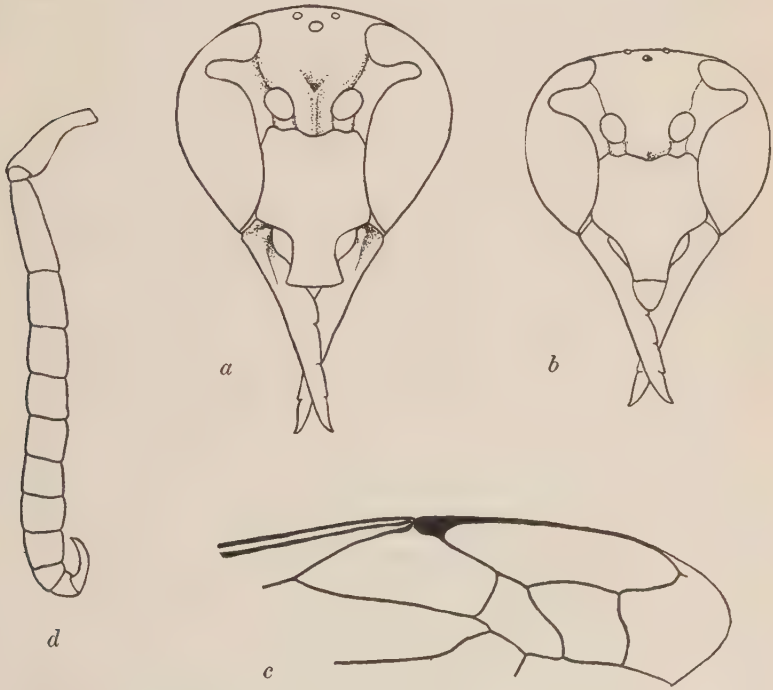


Fig. 1. Eumenes alluaudi J. Pérez. a, head of male in front view; b, head of female in front view; c, part of fore wing; d, antenna of male.

is nearly parallel-sided, but it has expanded apical angles as in *E. maxillosus*. In profile the posterior, broad portion of the petiole is less swollen and slopes more gradually toward the hind margin than in *E. maxillosus*. Second abdominal segment also more slender than in that species, with simple hind margin; its sternite regularly convex, but little if any flattened in the middle, never saddle-shaped. Fore wing (Fig. 1*c*) with the third cubital cell

much longer than in *E. maxillosus;* on the radial cell it is slightly shorter than high and about the length of the second cubital cell on the cubitus.

Punctation mainly as in *E. maxillosus.* The clypeus, however, is not dull and feebly shagreened as in that species, but shiny, varnished, with hardly any sculpture that can be discerned with a hand lens, except for a very few, scattered, minute dots toward the sides. The thorax is also somewhat more finely sculptured than in *E. maxillosus.* Pubescence a little more abundant than in that species, especially on the under side of the abdominal petiole.

Black, abundantly marked with chrome-orange (nearest orange rufous of Ridgway's color nomenclature). Head almost entirely chrome-orange, with the exception of the inferior margins of the eyes at the extreme base of the mandibles, the posterior half of the temples, the occiput, the vertex, and the emargination of the eyes, which are black. Antennæ orange-yellow, somewhat darkened above. Thorax chrome-orange; mesonotum black, except for a narrow, comma-shaped orange spot placed on each side of the middle line, close to the pronotum; most of the thoracic sutures more or less tinged with black. Legs chrome-orange. Abdominal petiole chrome-orange, except at its base, which is black. Remainder of the abdomen velvety pitch-black, except its last sternite, which is more or less ferruginous. Wings almost uniformly smoky, with a strong purplish effulgence.

Male. Length (head+thorax+tergites 1+2) 23 mm.

Differs from the female only in the secondary sexual characters. Clypeus much higher than broad, of a very peculiar shape (Fig. 1*a*): its basal portion is nearly rectangular and somewhat longer than its apical, free part; the latter forms a rectangular, projecting plate, abruptly narrowed from the basal portion and slightly widened at its feebly convex or nearly straight, apical margin; the lateral angles of the apical margin are blunt but prominent, bearing short, raised ridges. The inner margin of the mandibles has, near its base, a strongly raised, somewhat tuberculate fold. Antennæ (Fig. 1*d*) much as in the male of *E. maxillosus;* their last, hook-like joint intermediate in shape between that of *E. lepeletierii* and *E. caffer,* being long, almost uniformly thick for the greater

part of its length, feebly and gradually thickened toward its base, rather rapidly pointed at its apex, which is sharp and feebly curved; it can be folded into a small, deep, rounded pit at the extreme base of the under side of the tenth joint. Abdominal sternites three to seven more abundantly hairy than in *E. maxillosus*.

General coloration as in the female, but the posterior half of the petiole of the abdomen dorsally with a broad, heart-shaped, black mark (a black triangle with the apex directed posteriorly and the anterior base deeply emarginate). The last three abdominal sternites more or less ferruginous.

This species is evidently allied to *E. maxillosus*, but the male possesses such striking morphological peculiarities that it cannot be regarded as a color race of that species. I have been unable to find any close relative among the many species of *Eumenes* known from the Oriental and Indo-malayan regions.

The five females and two males seen by me are all colored much alike and come from the following localities: Mahé Island, Seychelles, 3 ♀♀; Seychelles, 1 ♀ and 1 ♂; Glorioso Islands, 1 ♀ and 1 ♀. All collected by Dr. W. L. Abbott.

E. alluaudi is known thus far only from the Seychelles and the Glorioso Islands (about 120 miles off the northern point of Madagascar, in the Strait of Mozambique), where no other species of the genus has thus far been collected. Very likely it is to be found also in the Comoros, although typical *E. maxillosus* alone has been recorded there. It evidently does not occur on Madagascar, which possesses two color forms of *E. lepeletierii* (*pensilis* Saussure and *guerini* Saussure) and one of *E. maxillosus* (*reginus* Saussure), all peculiar to that island, in addition to typical *E. maxillosus*.

J. Pérez described *E. alluaudi* originally from Mahé. Cameron[1] recorded it as common on Praslin and Mahé. G. Meade Waldo,[2] who gives Silhouette and Dennis Island as additional localities, notes that it "very often makes its cells in rooms; it was not observed in the highest forests." Its habits are thus evidently similar to those of *E. maxillosus*. The same author comments as follows upon the reddish chrome color pattern of *E. alluaudi* being

[1] Trans. Linn. Soc. London, Zool., (2) 12, 1907, p. 71.

[2] Ibid., (2) 15, 1912, p. 43.

repeated in *Odynerus seychellensis* Dalla Torre and *Crabro scotti* Turner: "It would seem that the insects with markings of this color are indigenous to the Seychelles, since none of the three species mentioned are found outside the group; on the other hand the widely spread and imported species preserve their normal type of marking."

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NOTES ON CANADIAN AND ARCTIC SPIDERS.

By J. H. Emerton,
Boston, Mass.

Since the report on the spiders of the Canadian Arctic Expedition of 1913 to 1916, the writer has had opportunity to examine a considerable number of arctic spiders from the American Museum of Natural History of New York and from the Zoological Museum of Copenhagen, Denmark, the latter including some from Iceland. The Iceland spiders appear to be mainly species living in the British Islands and Northern Europe, while those from Greenland are for the most part Canadian, extending westward to Alaska and Siberia, and southward through the bogs of Canada to the mountain tops of New England and the Rocky Mountains of Canada and the western United States. The following notes give the results of comparisons of spiders from Greenland with those of the same or similar species living in Canada and the mountains of the northern United States.

Hilaira (*Erigone*) **glacialis**, Thorell, 1871, Spiders of Spitzbergen and Beeren Islands.

Erigone vexatrix (Camb. 1877), Koch 1879, Spiders of Siberia and Nova Zembla.

Hilaira glacialis Kulczynski 1908, Spiders of Russian Expedition to New Siberia Islands.

Spitzbergen, Siberia.

Collinson Point, Alaska, Canadian Arctic Expedition.

Saunders Island, West Greenland, Crocker Land Expedition.

Hilaira (*Erigone*) **læviceps**, Koch, 1879.

Hilaira læviceps, Kulczynski, 1908.

Tmeticus brunneus, Emerton, 1882, Connecticut Academy.

Siberia.

Nome, Alaska, Canadian Arctic Expedition.

Banff, Alberta, Canada. Sulphur Mt., N. B., Sanson.

Mt. Washington, N. H. Emerton, Slosson.

East Greenland, Angmagsalik, 66° north, Kruuse.

Lophocarenum (*Erigone*) **barbata**, Koch, 1879.

Diplocephalus barbatus, Kulczynski, 1908.

Siberia.

Etah, West Greenland, Peary Relief Expedition, 1899.

Xysticus bimaculatus, Emerton, 1894. Canadian Spiders in Trans. Connecticut Acad.

Xysticus deichmanni, Sorensen, 1898. Vid. Med. Nat. For., Copenhagen.

Mt. Lincoln, Colorado, U. S., 10,000 ft. F. C. Bowditch, 1877.

Laggan, Alberta, Canada, 6,700 to 8,500 feet. Bean, 1890.

Eastern Greenland, 70° north. Deichmann, 1892.

Ashford, Washington, U. S. Emerton, 1905.

Arctic Canada, Bernard Harbor. Canadian Arctic Expedition, 1913 to 1916.

This species was found by F. C. Bowditch in 1877 on the upper part of Mt. Lincoln, Colorado, and it remained for a long time unidentified. In 1890 the females were found by Bean near Laggan in the Rocky Mountains of Canada, and described in 1894 by Emerton in a paper on Canadian spiders in the Transactions of the Connecticut Academy. About the same time it was found by Deichmann in Greenland and described in 1898 by Sorensen as *Xysticus deichmanni* in the Proceedings of the Natural History Society of Copenhagen, Denmark. The Canadian Arctic Expedition brought both sexes from the northern coast of Canada in 1916 and by comparison with these the specimens from Mt. Lincoln, Colorado, were at last identified.

Pardosa (*Lycosa*) **hyperborea**, Thorell, 1873, in Synonyms of European Spiders.

Pardosa luteola, Emerton, 1894. Canadian Spiders, Trans. Connecticut Acad.

Eastern Greenland, Th. Holm. Copenhagen Museum.

Southern Labrador, C. W. Townsend.

Quebec, Canada, Emerton.

White Mountains, N. H., in bogs at 4000 feet. Emerton.

James Bay, Canada, latitude 52½° north. F. Johansen.

Manitoba, Canada, west of Hudson Bay. Emerton.

Athabasca Landing, Canada, in bog. Emerton.

In bogs across Canada, from Greenland and Labrador to the Rocky Mountains and south to the mountains of New England and New York.

Pardosa furcifera, Thorell, 1873.

This is described by Emerton in Canadian Spiders, Trans. Connecticut Acad., 1894, as one of the varieties of *P. glacialis.* It occurs in Greenland, Labrador, and Arctic Canada. It is usually larger than the typical *glacialis* and lighter in color, with much bright yellow on the legs, especially the under sides of femora and coxæ. In the paper referred to, Fig 2a, Plate IV, represents this species, and 2b its epigynum. The palpal organ differs little from *glacialis* and its relatives, but the male palpus is more slender and not much darker in color at the end than at the base, without the close black hairs which are characteristic of *glacialis* and *brunnea.*

Lycosa exasperans, Cambridge, Ann. Mag. Nat. Hist., London, 1877, from English Exploring Expedition of 1875-76.

This species has been identified by Strand in Fauna Arctica, 1906, with *L. alpigera* = *L. insignita,* Thorell. It is, however, distinguished from that species by the dorsal markings. The middle stripe of the cephalothorax in *exasperans* narrows in front between the eyes, widens behind the eyes, and narrows again in its posterior half. In *insignita* it widens regularly toward the front, so as to enclose the whole eye area. The abdomen of *exasperans* has usually a series of dark marks in the middle and a row of black and white spots at the sides. *L. insignita* has a large white middle mark surrounded by a black border and the spots on the sides are indistinct.

L. exasperans was found by the Crocker Land Expedition, 1917, at Saunders Island on the west coast of Greenland.

L. exasperans resembles closely *L. pictilis,* Emerton, which has similar markings, but is larger, more largely marked with orange hairs, and has a more angular epigynum. *L. pictilis* is found on the Mt. Washington range above trees up to the highest summits, on the coast of Labrador, and on the arctic coast of Canada. The Labrador specimens unfortunately are all immature.

L. mutabilis and *L. poecila,* described by Kulczynski, from Siberia, appear to resemble closely *exasperans* and *pictilis,* and it seems probable that comparison of a larger number of specimens would show that all these are one species extending along the arctic coast from Siberia to Greenland and south through Labrador to the White Mountains.

Lycosa alpigena, Doleshall.
Lycosa insignita, Thorell, 1872.
Lycosa albohastata, Emerton, 1890.

Lycosa insignita, Thorell, supposed to be identical with *L. alpigena* of the Alps, is also the same as the American *L. albohastata*, Emerton. This species does not range as far north nor live at as high elevations as *L. exasperans* and *L. pictilis*, but it extends across America to the Rocky Mountains, being found several times at elevations of 5,000 to 6,000 feet at Banff. It occurs at low elevations on both sides of Hudson Bay, in Labrador, on the coast of Maine, and in the White Mountains just above the trees.

Drassus troglodytes, Koch, 1839.
Drassus troglodytes, L. Koch, 1866, Drassidæ.
Drassus robustus, Emerton, 1890, Trans. Connecticut Acad.
Southwest Greenland, Copenhagen Museum.
Iceland and Europe south to the Alps.
Massachusetts, New Hampshire, Mt. Mansfield, Vt.
Sandusky, Ohio, Chicago, Illinois.
Laggan, Alberta, Canada.
Vancouver Island, B. C., Canada.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

At the meeting, May 10, the committee on public lectures reported that four lectures had been given on Saturday afternoons in March and April in one of the small halls in Tremont Temple, on "Butterflies," by W. L. W. Field, on "Dragonflies," by R. H. Howe, Jr., on "Ants," by W. M. Wheeler, and on "Gall Insects" by A. C. Kinsey. An admission fee of 50 cents was charged, and there was an attendance of from one hundred to one hundred and fifty persons, so that enough was received to pay expenses of the course within ten dollars.

Mr. Reynolds reported the recent meeting of the New England Federation of Natural History Societies, in which three members of the Club took part.

Prof. C. T. Brues described a new minute Proctotrypid (Dol-

chotrypes) parasitic on Cecidomyid larvæ which live in the sap vessels of freshly cut wood. The parasite has a long slender abdomen which varies in length in different individuals and is used in placing the eggs into the vessels of the wood.

Mr. Frost spoke of recent collecting of beetles and the different identifications of them by several experts whom he had consulted.

Mr. Walker spoke of finding a small insect larva in freshly exuded spruce gum. This led to a discussion of insects in gum and amber, which was joined in by Mr. Denton, Prof. Wheeler and several other members.

At the meeting of June 14, Mr. L. W. Swett, who had lately been to the White Mountains, reported an unusually early season. At the Glen lilac and apple were in bloom, *Papilio turnus, Colias philodice, Pieris rapæ, Argynnis bellona* and *Thecla lœta* were flying. The nights were warm, 55° to 60°, and collecting by light was tried on the Mt. Washington carriage road. Many species were taken, but in small numbers.

Mr. Dodge showed 140 species of Coleoptera, all taken on June 12, near Wilmington Junction.

The first meeting of the autumn was held on September 13, and Mr. C. W. Johnson gave an account of collecting at Mt. Desert, Maine, in June. The mountain maple, several species of Cornus, and raspberries were in bloom, and many insects were swept from the plants, among them many not before found on the island. Two thousand species of insects are at present known on Mt. Desert, more than half of them Diptera and Lepidoptera.

Mr. O. E. Plath showed several nests of bumble-bees which he had kept in boxes through the summer, and told about his observations on them, which will be published later in the year.

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